AVIATION

JANUARY 9, 1922 Issued Weekly PRICE 15 CENTS

Smoke Screen Laid around the Alabama by U. S. Army Airplanes

Photo U. S. Army Air Service

VOLUME XII
Number 2

SPECIAL FEATURES

JL6 MONOPLANE MAKES NEW WORLD'S DURATION RECORD

THE WORK OF McCOOK FIELD IN 1921

TREND OF AVIATION DEVELOPMENT

THE MARKET FOR COMMERCIAL AIRCRAFT IN 1922

Four Dollars a Year

THE GARDNER, MOFFAT CO., INC.
HIGHLAND, N. Y.
225 FOURTH AVENUE, NEW YORK

Entered as Second-Class Matter, Nov. 22, 1920, at the Post Office at Highland, N. Y.
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PROGRESS

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DAYTON, OHIO, U. S. A.

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JANUARY 9, 1922

AVIATION

VOL. XII. NO. 2

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THE GARDNER, MOFFAT COMPANY, Inc., *Publishers*

HIGHLAND, N. Y.

225 FOURTH AVENUE, NEW YORK

Subscription price: Four dollars per year. Single copies fifteen cents. Canada, five dollars. Foreign, six dollars a year. *Copyright 1922, by the Gardner, Moffat Company, Inc.*

Issued every Monday. Forms close ten days previously. Entered as second-class matter Nov. 22, 1920, at the Post Office at Highland, N. Y., under act of March 3, 1897.

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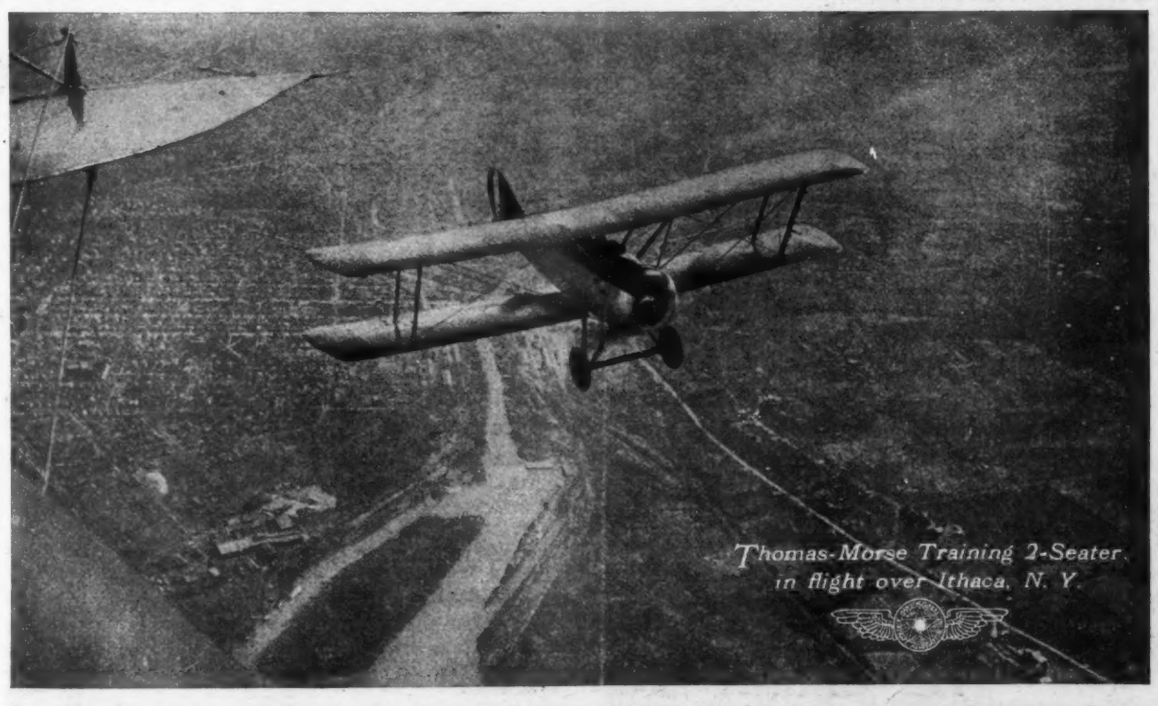

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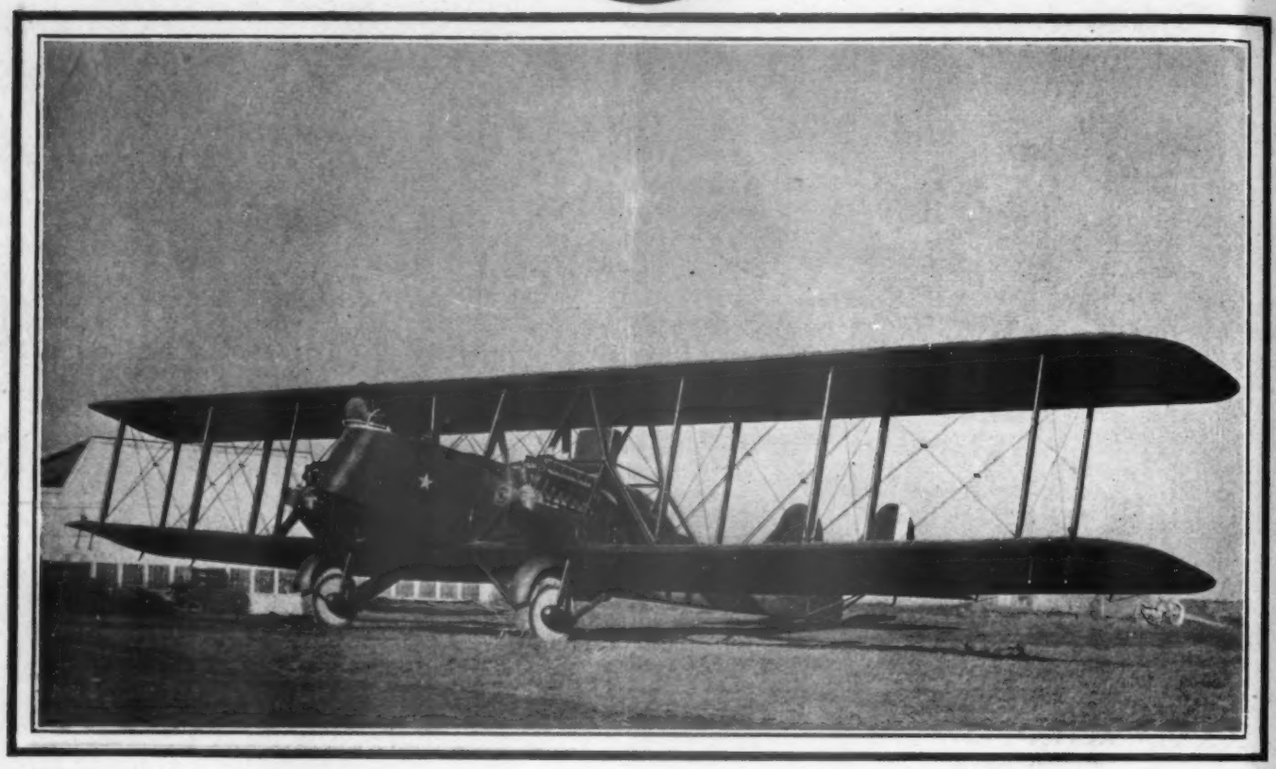

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LADISLAS D'ORCY
EDITOR
ALEXANDER KLEMIN
EDWARD P. WARNER
RALPH H. UPSON
CONTRIBUTING EDITORS

Vol. XII JANUARY 9, 1922 No. 2

The New World's Duration Record

THE new world's duration record of 26 hr. 19 min. 35 sec. which Eddie Stinson and Lloyd Bertaud made on the JL6 monoplane is an accomplishment which reflects the greatest credit on the airplane in question as well as on the men who piloted it in turns.

From the engineering viewpoint this performance is chiefly of interest in demonstrating the reliability of the B.M.W. engine which powered the airplane, and also the ruggedness of the engine installation. It is a well known fact that by far the greater part of what is commonly called "engine trouble" is due not to a faultiness of the engine itself but to the fragility of accessories, such as the fuel, oil, and water lines, the engine controls, etc. This point is well brought out in the paper on the trend of aircraft development which Mr. Vincent read before the Society of Automotive Engineers, and which is reprinted in this issue. On the record-breaking JL6 monoplane the normal engine installation functioned perfectly, and it was only toward the end of the flight, when lubricating oil had to be drawn from the auxiliary tank specially installed for the performance, that difficultes arose, and these finally forced the aviators to land.

The human endurance displayed in this flight by the two aviators is evidently beyond all praise, and one which is not within the power of the average pilot, no more than are flights to the highest altitudes so far attained. This is convincingly shown by the fact that when the world's duration record of 24 hr. 12 min., which Reinhold Boehm established in an Albatross biplane on July 7, 1914, was broken two years ago by Pilots Bossoutrot and Bernard in a Farman Goliath, the latter had added only 7 min. 7 sec. to the previous record, although their machine was capable of a much longer flight. It is therefore all the more creditable that Pilots Stinson and Bertaud should have exceeded the previous world's duration record by more than two hours, thus winning for America a distinction which is one of the most difficult to establish.

Properties of Helium and Hydrogen

IN the editorial "Helium as an Aid to Airship Piloting" which appeared in our last issue an inadvertent change in the original wording, made necessary by a contraction of the text to fit the space, somewhat vitiated the meaning of the last paragraph. This paragraph should read: "Sudden changes in *altitude* cause helium to contract and expand at a lesser rate than in the case of hydrogen."

To this might be added that it is only under *adiabatic* conditions that helium acts in a manner sensibly different from hydrogen. Any gas cools when it rises, or heats when it descends, owing to the change in atmospheric pressure. With helium this change in temperature is greater than with hydrogen; hence its change in volume, due to combined pressure and temperature, is *less*, and there is a *greater* force tending to return the balloon or airship to its normal altitude.

The Work of McCook Field

THE article on the work of McCook Field in 1921 which we reprint in this issue from our contemporary *Slipstream*, affords under the authorized pen of Major Bane an interesting insight into the latest activities of the Engineering Division of the Air Service.

A perusal of this article will show that the official silence which as a rule, surrounds the work of McCook Field should not be taken as indicating that the Engineering Division of the Air Service is inactive. Far from that, it will be seen that much new aeronautical equipment has been developed by, or tested at, McCook Field, including such varieties as all metal airplanes of different types, high powered machines answering special purposes, "super-powerplants," etc.

Practical demonstration of the value of the work done by McCook Field is, in the very nature of things, not often forthcoming in such manner that those outside the organization can realize it, and it is only when men like Schroeder and MacReady make new world's records that the Engineering Division of the Air Service publicly receives the credit to which it is entitled.

The Aero Club Banquet

THE annual banquet of the Aero Club of America, which after a lapse of two years is to be held again this year, on Jan. 9, the date of this issue, promises to be a highly successful and widely attended affair. All those who for one reason or the other missed the last Aviators Armistice Dinner, will want to attend this aeronautical gathering in which many problems pertinent to aviation will be discussed in the form of speeches as well as of informal conversations.

It is generally conceded by constructors, operators and underwriters of aircraft that the coming twelve months will see a not immaterial revival of American aviation, it being likewise admitted that the past year marked the minimum contraction of the aircraft industry.

One of the conditions making such a revival possible is the expected passage, by Congress, of the Wadsworth-Hicks Bill, which provides for the creation of a Bureau of Civil Aviation. We cannot, in this connection, but repeat what we have said before so many times, namely, that federal air legislation is absolutely needed for instilling in the public confidence as to the safety and reliability of civil aircraft and at the same time, for putting aviation on a legal basis which has considerable importance from the viewpoint of the business world.

JL6 Makes New World's Duration Record

Piloted by E. Stinson and L. Bertaud, Metal Monoplane Stays Aloft 26 hr. 19 min. 35 sec.

A JL6 monoplane, piloted by Eddie Stinson and carrying as a relief pilot Lloyd Bertaud established on Dec. 29-30, at Roosevelt Field, L. I., a world's endurance records of 26 hr. 19 min. 35 sec., subject to corrections in seconds when the three timing chronometers are calibrated.

The JL6 took the air from Roosevelt Field at 8:58.15 Dec. 29 with 2131 lb. of gasoline, equal to 360 gal. estimated sufficient for 36 hr. flight, and a total load of 5400 lb. or one and a quarter times the weight of the machine. When Stinson landed the JL6 the following day there remained from six to seven hours supply of gasoline and oil in the tanks. Both pilots stated that they would undoubtedly have been able to remain in the air until their gasoline supply was exhausted, or approximately 36 hr., had it not been for the failure of their auxiliary oil pump system which started to give trouble at 2 a. m. Dec. 30.

This system consisted of a hand pump and rubber tubing connecting the auxiliary oil tanks in the cabin with the main oil tank. When the pump failed, a hole was punched into the main oil tank and a rubber tube inserted in an attempt to syphon the oil from the auxiliary tank to the main tank. This makeshift proved very unsatisfactory, and the pilots were later compelled to pour oil by hand into the main tank. This oil sprayed their faces, obscuring vision and made piloting a hazardous matter. As a result, both Stinson and Bertaud were thoroughly soaked with a high grade of lubricating oil when they landed, numb and stiff from cold.

Three of Stinson's fingers were frozen in trying to patch up the oil connections when he had to remove his gloves. Neither pilot ate any of the sandwiches which they carried aloft, although they consumed all the coffee contained in two large thermos bottles, nor did either attempt to sleep, preferring to remain constantly alert and fearing the effects of numbness from the cold.

Stinson remained practically the entire time in the open front cockpit from 4 p. m. Dec. 29 until he landed the ship at 11:17.50 the following day. It had been the intention of the pilots to relieve one another and secure some sleep. They decided, however, to remain awake as it was a case of "flying the ship" every minute from the time it took off with its great load of gasoline and oil in a violent snow storm through the night with a temperature in the open cockpit below zero and buffetted constantly throughout the test by gales varying from 20 to 50 m.p.h.

The Take-off

The ship took off with remarkable ease, considering its great load, in a run of not over 250 yd. The pilots reported that the engine was run at 1400 r.p.m. in getting off and that it averaged 1075 r.p.m. after gaining the desired altitude, with a speed at the start with full load of only 65 m.p.h. and an average high speed of about 90 m.p.h. During the night the plane could be seen at times practically hovering in the air when headed into the gale. Throughout the hours of daylight and darkness both pilots took skilful advantage of the weather by throttling down the engine when headed into the wind.

The JL6 monoplane (185 hp. B.M.W. engine) on which Eddie Stinson and Lloyd Bertaud made the new world's duration record of 26 hr. 19 min. 35 sec.

During the night four flares were laid out in the form of a half mile arrow pointing NW. At the northwesterly point of the arrow a red flare was placed while at the extreme southeasterly base of the arrow a white flare was set, while on the right and left sides red flares were placed. The pilots reported that they were able to see these flares at all times during the night showing their exact direction at a glance.

The Following Morning

At 3 a. m. on Dec. 30 the machine came close to the ground and the official Aero Club watchers as well as Mr. Larsen feared that the machine was going to land, but it soon veered off and started out on its regular 30-mile circuit of Mineola, Westbury, Garden City and Hempstead.

The Aero Club was represented by the following officials, all of whom were formerly pilots: E. A. Holtham, R. Uber, Howard A. Scholle, Wm. Royce, H. M. Sushan. These men worked in shifts.

Two recording barographs were placed in the machine by

the Aero Club officials and upon being taken out and checked, proved conclusively that the machine had remained in the air during the entire 26 hr. Three Jules Jurgensen chronometers were used for timing the flight. There were supplied by the New York Timers Club and checked by Western Union Time from the Washington Observatory. The official figures may show a slight variation in seconds from the announced time after these instruments have been calibrated.

The performance of the JL6 is the more impressive in view of the fact that Mr. Larsen did not seek nor did he receive any assistance or cooperation from the government or otherwise. There was no ground organization whatever; the machine remained in the open field throughout the night preceeding the start without protection other than a blanket over the radiator. The pilots climbed aboard, the mechanic spun the propeller and they were off without any preliminaries or hoorah, and they landed over 26 hr. later near a little tumble down shack where the official watchers had been freezing in shifts through a day and night, amid a subdued scene of congealed enthusiasm. In all a matter of fact performanee which crowded into 26 hr. the greatest boost for commercial aviation during the year 1921.

Stinson and Bertaud

Edward Stinson and Lloyd Bertaud, both 27 years old, have long been identified with aeronautics. Stinson is credited with having trained more American fliers during the war than any other man. Barred from the Army by reason of delicate health, he opened a field near San Antonio, Texas, as a civilian adjunct of the Air Service, and initiated the embryo airmen into the intricacies of stunt flying. When the war was over the Government awarded him a commission. As a stunt flier Stinson has few peers.

In his ten years' experience as an aviator he has never had a crash or broken any part of his plane. Stinson has two sisters, Catherine and Marjorie, who have made names for themselves as expert fliers.

Lloyd Bertaud has had much experience as an aviator and instructor, and, piloting an Ansaldo "Balilla" fitted with a 400 hp. Curtiss K12 engine he won the 140 mile American Legion Aerial Derby at Kansas City last September.

Their Impressions

"It's good to be able to walk again," said Stinson. "I'm nearly frozen. We could have staid up until dark. Too much oil; that was the trouble." Stinson held up his right hand. "Three fingers frozen!" he said. "One finger frozen on the other hand, too. I'm going home to bed. I feel as if I would never get warm again."

"We had intended to eat a lot and sleep a lot—alternating at the controls—but we did neither. We started off with twenty roast beef sandwiches, twenty-five bars of chocolate and four big thermos bottles of coffee. But for fear one or the other might become ill, we ate lightly, and it was so cold we thought we might become numbed if we slept. So we both stayed up all the time, doing a 50-50 stunt at handling her."

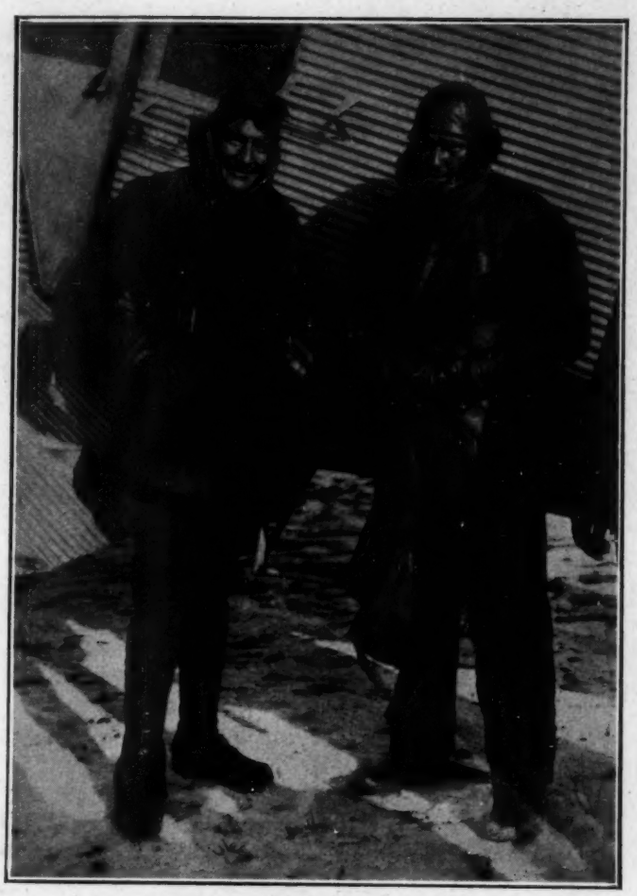
"Normally the ship will use seventeen gallons of gas an hour," Stinson said, "but we kept her consumption down to about twelve gallons most of the time. And the motor never skipped once in the whole flight. It would have gone badly with us if she had failed when we were just skimming the ground during that snowstorm."

Describing the flight to newspaper men, Bertaud said:

"Our first four hours in the air yesterday were flown between fifty and seventy feet above the ground. The snowstorm raging then was so heavy that we could not go any higher and see the earth. We had to dodge church spires and chimneys frequently. Once when I was piloting the machine we almost hit the old chimney of the Camp Mills Hospital.

"Stinson and I did not do much talking until after we found we had been flying over twenty-five hours and knew that we had beaten the world's record. We both turned around in our seats and shook hands with each other.

"We encountered our first difficulty about 2 o'clock in the morning, when the oil from the auxiliary tank began to thicken from the cold and would not feed well. We discussed the question as to whether we should land. We decided not to quit as long as the plane would remain in the air. We hit upon the plan of pouring the oil into the tank and not depending on the feed pipe.



Eddie Stinson (left) and Lloyd Bertaud after the great flight

Poured Oil in Tanks

"While one of us steered the other had to lift the five-gallon auxiliary oil cans, into which we had punched holes, in order to pour the heavy mixture into the tank. It was so thick that we could pour only about a quart at a time. Great care was required to keep the oil from running out, thereby burning out the bearings and destroying the motor. Incidentally, our

Coming Aeronautical Events

AMERICAN

Jan. 9—Annual Banquet, Aero Club of America.
Apr. 30—Spring Show and Opening Meet, Curtiss Field, Mineola, L. I.
May —National Balloon Race.
Sept. 4—Detroit Aerial Water Derby, Detroit. (Curtiss (about) Marine Flying Trophy Competition.)
Sept. 15—Detroit Aerial Derby, Detroit. (Pulitzer Tro- (about) phy Race.)
Sept. 30—First Annual Interservice Championship Meet. (In preparation.)

FOREIGN

Aug. 1—Coupe Jacques Schneider. (Seaplane speed (about) race.) Italy, probably Venice.
Oct. 1—Coupe Henri Deutsch de la Meurthe. (Airplane speed race.) France.
American elimination trials, if required, to be held about Aug. 15, at Mitchel Field, L. I.

OUTSTANDING FACTS OF RECORD ENDURANCE FLIGHT

Machine	*JL6, 7-place all metal cabin monoplane*
Owner	*John L. Larsen, President J. L. Aircraft Corp.*
Engine	*185 hp. B.M.W.*
Pilots	*Edward Stinson and Lloyd Bertaud*
Time	*26 hr. 19 min. 35 sec.*
Place	*Roosevelt Field, Long Island.*
Start	*8.58.15 a. m. Dec. 29, 1921.*
Finish	*11.17.50 a. m. Dec. 30, 1921.*
Previous Record	*24 hr. 19 min. 7 sec. made in France with Farman Goliath, (2-260 hp. Salmson engines) L. Bossoutrot and J. Bernard, pilots. June 4, 1920.*
Record equaled	*at 9.17.7 a. m. Dec. 30.*
Mileage	*approximately 2,200.*
Low Speed	*65 to 70 m.p.h.*
High Speed	*90 m.p.h.*
Extreme Altitude	*4,100 ft.*
Low Altitude	*300 ft. during snow and fog.*
Weight Empty	*2,400 lb.*
Loaded for Flight	*5,400 lb.*
Gasoline	*360 gal.: 2,132 lb. (estimated for 36 hr.)*
Oil	*28 gal.*
Average Gas Consumption	*12 gal. per hr.*
R.p.m. at start	*1,400.*
R.p.m. toward finish	*1,075.*

hands, which had become numb just before midnight, got back some of their feeling with this strenuous work.

"Flying around and around the country was monotonous, especially after the darkness set in. The fatigue from the cold was terrible. We did not dare to go to sleep for fear that we would become so chilled and numbed that when we awoke we would not be able to handle the plane. We had to maintain a constant vigil to keep the plane at an altitude where it would consume the least amount of gasoline.

"When we started the flight the motor was turning up 1,400 r.p.m. and when we landed it was 1,075 r.p.m. The motor under ordinary circumstances will consume about seventeen gallons of gasoline an hour. With the engine throttled down we used about twelve. The principal factors in a test of this kind are reliability, economy and good handling. During the night we never flew out of sight of the night flares at Roosevelt Field and Larsen Field, at Central Park, L. I. Sometimes during the long hours of the night we hovered over Freeport to vary the monotony.

"I have never flown more than twelve continuous hours before and I doubt if Stinson has. I do not care to try it again under such adverse weather conditions as we had on this occasion."

Congratulations from the Air Service

Maj. Gen Mason T. Patrick, Chief of Air Service, sent the following radiogram to Pilot Stinson:

"The Army Air Service is pleased to extend to a former member its congratulations on the remarkable duration record just attained by him."

MASON T. PATRICK,
Chief of Air Service

Aero Club Banquet

The Fourteenth Annual Banquet of the Aero Club of America to be held at the Hotel Commodore, Jan. 9, at seven o'clock, promises to be one of the most interesting gatherings ever assembled in the history of American aeronautics. The achievements of the Army and Navy in bombing battleships, are bound to have a far reaching effect in future warfare.

The coming year promises even greater things. Plans for extending the national activities of the Aero Club of America will take definite shape at this Banquet.

The award of the Mackay Trophy to Lieut. John A. Macready for breaking the world's altitude record, which will be made at this banquet, marks one of the four world's records achieved by America during the past year. The cross-country speed record made in the Pulitzer Race at Omaha on Nov. 3, 1921, by Bert Acosta of 176.7 m.p.h., was the second world's

The original New Year's card sent out by A. & D. R. Black, Consulting Aeronautical Engineers

record to be made this year, and the four passenger altitude flight by Mr. Loening's Air Yacht of 17,550 ft. made recently by Pilot Dave McCulloch, gives a seaplane record to this country, while the recently made world's record endurance flight of Mr. Larsen's JL6 monoplane piloted by Eddie Stinson and Lloyd Bertaud, of approximately 26 hr. and 19 min. at Roosevelt Field, gives us a list of achievements in the military and sporting world of which we may well be proud.

Charles F. Kettering will act as Toastmaster and Rear Admiral W. F. Fullam, General Mason M. Patrick, Rear Admiral William A. Moffett, Congressman Hicks, William G. McAdoo and Hon. Benedict Crowell have accepted the Aero Club's invitation as guests.

New Air Mail Hangar at Crissy Field

Mr. Caldwell, Air Mail Superintendent, has let the contract for a new hangar at Crissy Field. Work was begun on Nov. 28, and it is expected that construction will be completed and the hangar ready for occupancy in thirty days. The hangar now used by the Air Mail Service will be turned over for the use of the Reserve Squadrons now organizing in the vicinity of San Francisco.

Fast Air Mail Flight

Pilot Claire K. Vance of the Aerial Mail Service must have surely had some wind on the tail of his plane when, on Nov. 21 he made the trip to Elko, Nevada, from Reno, Nevada, a distance of some 235 mi., in one hour and twenty minutes. There have been hints cast that Vance was a speed demon, and now it goes without saying.

Work of McCook Field in 1921

Engineering Division, Army Air Service Developed and Tested Several New Types of Airplanes, Engines and Equipment

By Major T. H. Bane

Another milestone has been reached in the history of the Engineering Division of the Air Service. Some of the problems which have followed us from the original organization, are still unsolved. First of all there is the question of a permanent site for this Division. Complete plans including suggested arrangement of buildings and offices, have been prepared, which would be applicable to any reasonable piece of ground. The economy being practiced by the Federal Government at the present time has prevented pushing the question of a permanent site for the Engineering Division. No immediate relief seems possible.

It is always well, near the end of the year, to look back over the accomplishments of the year with the view of forming an opinion as to whether it has all been worth while. It is believed that a careful analysis of our accomplishments during the past year will force any reasonable man to the conclusion that the work that we have done in the Engineering Division has been worth while.

The Air Service has been reorganized and the Engineering Division has been placed as one of the five independent divisions reporting directly to the Chief of Air Service. In order to assist the "doubting Thomases" we will list some of the high points of our past year's work.

New World's Altitude Record

We were able again to break the world's altitude record, Lieutenant Macready going to an altitude of 37,670 ft. in the old Lepere which seems destined to keep pushing on and on in its search for the roof of the world. The experience gained through Major Schroeder's flight made it possible to protect Lieutenant Macready from the elements much better in his flight, and it is felt that he will be able to go considerably higher during the next year.

We were unable to compete in the Pulitzer Race this year, but Lieutenant Macready represented this Division by flying the MB-6 for the Thomas Morse Co. and winning third place.

The 700 hp. "W" engine which was built last year has successfully passed its 50-hour test. A small number which were ordered have been received and are now being tested. This engine has been incorporated in the design of several airplanes, one of which is now at this Field. It is believed that we should be justly proud of the accomplishments of the Power Plant Section in the development of this engine.

The 1000 hp. Engine

Following the same procedure as was followed in the development of the 700 hp. "W" engine, a 1000 hp. engine is now being built. This procedure consists of completely developing a single cylinder on the flexible engine last year and letting the contract this year for the complete engine.

A remarkably compact engine of the barrel type with many advantages over existing conventional types is actually under construction.

With the co-operation of the Material Section, the Power Plant Section has been able to develop a very promising air-cooled cylinder.

Mr. Verville and the Power Plant Section have gotten out during the past year a very creditable pursuit airplane about the Packard 300 engine.

Metal Airplanes

Mr. Laddon who seemed destined to break the ice in new forms of construction in this Division, has gotten out the CO-1 which passed its sand test except for minor defects, which it is believed will be corrected. This duralumin airplane is the first attempt in this country to build a complete duralumin airplane and gives every promise of success. The flying model should be in the air soon after the first of the year.

New Training Airplane

Mr. Roche completed the construction of the training airplane about the Liberty-6 (TW). This airplane contains some very interesting features, particularly that portion designed to lessen the number of fatal accidents in training. Mr. Roche also designed last year the CO-2 or Corps Observation airplane of steel tubing, about the Liberty engine. This will be built during the present fiscal year. The work of this Division in successfully supervising the development of the Packard series of engines is very praiseworthy, as is also the work of the Airplane Section in supervising the experimental construction of the following airplanes:

The Loening Monoplane, which resulted from over three years careful study by Grover C. Loening, seems to be a real promising pursuit type. Several modifications have been incorporated in two additional airplanes and a small production order will be made this year. This airplane has some very interesting and unusual features.

The sand test model of the armored pursuit about the 300 hp. cannon Wright engine, has been received and looks like a serious undertaking. It will be remembered that this airplane was designed at this field by Mr. Laddon's group and built by the Aeromarine Co.

The Loening Pursuit Biplane

The sand test model of the Loening biplane about the 350 hp. Wright radial aircooled engine has been received and shows a great deal of intelligent engineering. It is a very interesting pursuit type and is a great credit to both the Loening Engineering Corp. and to the engineers in this Division who assisted in the criticism and changes in the design.

The sand test model of the Gallaudet day-bombardment airplane about the 700 hp. "W" engine has arrived at this Field and has created a most favorable impression. It is a source of great satisfaction to this Division to see that Mr. Galluudet and his organization have done what appears at first glance to be an excellent piece of work in the development of this all-metal airplane. It certainly impresses one as a distinct advance in the science. This model has not been sand tested and may require considerable modification.

Balloon and Airship Section

During the past year we have added to our organization the Balloon and Airship contingent, including two main sections, the Balloon and Airship Section and the Transportation Section. We wish to apologize to these gentlemen for the lack of facilities that they have to carry on the work in hand. We hope at an early date to be able to extend their facilities so they can have airships to operate and can be of real material assistance to the Lighter-than-Air division of the Air Service.

The Equipment Section have continued the development of the multitudinous variety of articles for which they are responsible in a most satisfactory manner. In this connection the work of Captain Stevens and Lientenant Wade in the White Mountains is mentioned as a most creditable performance on the part of these officers and is another feather in the cap of the Engineering Division. Certainly this type of thing was never done before and was performed in this case with practically a perfect score.

New Instruments

The earth inductor compass, cloud flying instrument board, non-frosting goggles and radio controlled car are some of the "high-lights" in the work of the Equipment Section.

The Armament Section, although practically swamped with projects and deprived of its former chief, Major Hobley, has accomplished many very difficult tasks under the able leadership of Captain Kauch. The perfection of the electrical synchronizer and the 4000 pound bomb rack, the Estoppey bomb sight, the Universal bomb hoist and the improvement of the nose of the Martin Bomber to facilitate accurate bombing, are some of the main accomplishments.

The Material Section has handled a great amount of current testing and has convinced the other Sections at the Field of its desire to help with their problems and a very excellent cooperation has been built up. Captain Flickinger was detached and sent to Panama in the early part of the year, but the work has been carried on ably under Mr. Johnson's leadership.

The work of the Contract Section continues to be most satisfactory, although they have been seriously handicapped by the stringency of current procurement regulations. Certainly their application to their job makes them an excellent model for the rest of the Division. It is hoped that the addition of Captains Parness and Fenn will ease up the routine work of the Section and allow them more time to assist in solving the problems of this Division.

Dr. de Bothezat's Work

It would be a serious oversight to mention the work of the Engineering Division during the past year, without giving full credit to Dr. de Bothezat and his organization for the very serious and important undertaking which they are accomplishing for the Engineering Division. It is believed that this work is the most important ever undertaken by this Division and may have greater consequences than anything that we have ever done. The work is progressing most satisfactory under the able management of Dr. de Bothezat and his group. —*Slipstream.*

Foreign Air Budgets

Italy has increased her air budget for 1921-22 to 66 million lires, an advance of over 26 million above the 1920-21 budget. In Siam, the government is augmenting the air force, as well as giving generous support to civilian and commercial flying.

In China, there appears to be a hitch over the finances of the healthy provision for commercial air services made by the government, as many times referred to. According to recent reports to hand there are now at the Nan Yuan airdrome thirty airplanes daily engaged in flying and one hundred are as yet unpacked. All are of the latest type and finest workmanship. An able staff of foreign advisors and flying experts has been busy in training the Chinese, many of whom have creditably passed the preliminary tests.

National Guard Aero Squadron Organized

The 137th Observation Squadron, Air Service, Indiana National Guard, was granted Federal recognition on Aug. 1, 1921, and has to date received most of its equipment. Two large steel government hangars, size 66 x 120, have been received. Ships are being set up at Wilbur Wright Field at the present time and will be flown to Kokomo, Indiana, the location of this squadron, very shortly.

The minimum strength of the squadron is 24 officers and 90 enlisted men, and the maximum strength 132 enlisted men and 31 officers.

Reorganization of the Office of the C. of A.S.

New Organization Plan Provides for Five Divisions: Personnel, Information, Training and War Plans, Supply, and Engineering

Under the reorganization of the Office of the Chief of Air Service, approved by General Patrick on Dec. 1, 1921, five divisions are provided, viz: Personnel, Information, Training and War Plans, Supply, and Engineering. The office of the Chief includes the Assistant Chief of Air Service and the Executive Office. Subordinate to the Executive Office are the Finance and Medical Sections, the Legal Advisor and the Director of Aircraft Production (Spruce Production Corporation). The Orders and Files Section is under the immediate supervision of the Chief Clerk.

The Personnel Division is composed of three sections—Officers, Enlisted and Civilian. The Information Division comprises the Library Section, Special Section and Reproduction Section. Five Sections comprise the Training and War Plans Division, viz: Schools Section, Tactical Units Section, R.O.T.C., National Guard and Officers Reserve Section, War Plans Section and Airways Section. The Supply Division embraces the Property-Requirements Section, the Procurement Section and the Material Disposal and Salvage Section. The Engineering Division, located at McCook Field, Dayton, Ohio, a technical representative of which is on duty in Washington, is composed of the Planning Section, Technical Section, Factory Section, Flying Section, Procurement Section, Supply Section, Patents Section and Military Section.

The following assignment of officers on duty in the office of the Chief of Air Service has been made:

Executive	Maj. Walter H. Frank
Assistant Executive	Maj. Hubert R. Harmon
Chief of Personnel Division	Maj. Rush B. Lincoln
Chief of Information Division	Maj. Horace M. Hickam
Chief of Training and War Plans Division	Lt. Col. James E. Fechet
Chief of Supply Division	Lt. Col. Wm. E. Gillmore
Chief of Engineering Division	Maj. Thurman H. Bane
Chief of Finance Section and Budget Officer, Air Service, in Office of Executive	Maj. Jenner Y. Chisum
Chief of Medical Section in office of Executive	Col. Albert E. Truby

To duty in:

Personnel Division; Maj. J. W. Simons, Jr., 1st Lieut. George E. Hodge.

Information Division. Capt. David S. Seaton, 1st Lieut. Charles H. Mills.

Training and War Plans Division: Maj. Herbert A. Dargue, Maj. Walter G. Kilner, Maj. Percy E. Van Nostrand, Maj. Leo A. Walton, Maj. Oscar Westover, Maj. Barton K. Yount, Capt. Oliver S. Ferson, Capt. Burdette S. Wright, 1st Lieut. Robert J. Brown, Jr., 1st Lieut. Wm. E. Connolly and 1st Lieut. Horace S. Kenyon.

Supply Division: Lt. Col. Harry Graham, Maj. Roy M. Jones, Maj. George E. A. Reinburg, Maj. Walter R. Weaver, Capt. Frederick F. Christine, Capt. Aubrey I. Eagle, 1st Lieuts. Wm. V. Andrews, Charles G. Brenneman, Edwin F. Carey, Aaron E. Jones, Benjamin R. Morton, and Edwin R. Page.

As Engineering Representative: Maj. Henry W. Harms and 1st Lieut. Ernest E. Harmon.

Office, Assistant Chief of Air Service: 1st Lieut. Clayton L. Bissell.

Finance Section: Capt. William F. Volandt.

Medical Section: Maj. Benjamin B. Warriner and Capt. William J. Freebourn.

The Market for Commercial Aircraft in 1922

A Practical Program for Developing the Aircraft Market--Aviation a Transport Industry--Convincing the Public

By Harold F. Marshall

A definite practical program of market development is needed by the aircraft industry. This article is an attempt to consider one phase of the market problem—namely, the market most susceptible of immediate development, of results attainable in the coming year. After showing where this immediate market lies, an attempt will be made to outline the most effective method of development—taking into consideration first, the limited funds available for publicity and second, the fact that an advertising campaign should be self-supporting, although the good-will which is created may be considered as part of the profits.

A recent session of the American Society of Mechanical Engineers was devoted to the consideration of the problem of Waste in Industry. The Waste Report showed that market problems played a considerable part in the creation of waste. In the aircraft industry, the problem is mainly that of preventing future waste. If the ground work can be laid now to mould aircraft development; to compensate for the continued wasting away which has followed the over development caused by war, and to develop and stabilize the market, a healthy industry will be assured.

Aviation a Transport Industry

What kind of an industry is aviation? The general form is already recognized—for one thing, it is a strictly professional industry—creation and operation will and must be in the hands of the professional and out of the hands of the amateur, for safety's sake. But the professional must not forget that every other agency can and must be continually called into play for its development. If we must have an analogy for discussion let us remember that it is not the motor car industry —which, from the operating view-point is the greatest amateur occupation in the world. But aviation is basically a transportation industry and does resemble the other transportation industries—shipping and railways.

Since the general path for the future is fairly determined—what can be done in the coming year—to speed up the absorption of converted war equipment—to increase the production of new commercial machines—and to get commercial flying on a profitable operating basis,

Certainly data for the betterment of designs are not lacking —in no industry is there a richer supply of material of this nature. Nor are production facilities lacking—the opposite is rather true. Personnel is neither lacking, and now is an excellent time to absorb good personnel back into the industry. Even if the number of men returned to aviation activities is small it will help the employment readjustment that is under way.

The need for market development is thus seen to be the main problem of the industry. To find the most promising market and concentrate on its development—that is the problem on which the whole industry should center its attention.

The Marketing Problem

The importance of the marketing problem of an industry can be illustrated by reference to the mens clothing industry in the above-mentioned waste report. A condition was found which surprised even the engineers making the investigations. Unsatisfactory labor conditions and uneconomic over-equipment of plants, which unnecessarily tied up immense capital, were traced directly to a faulty method of sales and distribution— in other words, faulty marketing methods. It is going to cost money to remedy this condition—a great deal more money than would be the case if they had planned their market instead of letting it "grow wild".

It is necessary to consider this problem from the view point of the entire aircraft industry. It affects more than the sales department—it determines the condition of the other elements —advancement of engineering and design depends on finding an outlet for the "stock on hand" of brains as well as material.

Consider the aircraft market of yesterday and today. The sportsman can be disregarded—because of the professional nature of aviation he will take a continually smaller percentage of the output. Exhibition flying has passed—except the wing-walking type of exhibition which is doing the industry real harm. Governments have figured as the biggest customers and will doubtless continue to do so for some time. This in itself is a weakness of the industry—for no matter how you delve into politics you cannot make this a market of stable demand. As for the civil end of business—it will grow only as fast as you can convince the average man in the street that air transport and travel can be profitably used.

Convincing the Man in the Street

The problem of convincing the man in the street is of the greatest importance—it is a problem of demonstration and education. And this in turn is a matter of flying and advertising. Of all the factors retarding the development of the industry this lack of public confidence and knowledge is greatest. The seriousness of this fact is hard to realize. While progress in design, construction, operating methods, efficiency and even regulation is being made, ground is actually being lost in the minds of the lay public. As the public attitude can only be moulded slowly, it requires continuous attention.

Consider the forces now actively moulding public opinion on aviation. Advertising men and psychologists know that sensational freak performances do not count in developing confidence although they do arrest attention—the forces that count to this end are those which reach the daily routine life of the public.

How is aviation being brought into the daily routine life of the public? At present there are evidently four major influences acting. First there is the daily featured report of the latest accident. Second there is the "movie" of the latest wing walking stunt or other sensational achievement which makes Mr. Average American repeat that "aviation ain't for me."

Third there is the present "tramp" passenger carrier who travels like a small circus, with a poorly equipped plane and all the ear-marks of an under-financed pioneer and no evidence of good management. It is not meant to disparage these enterprises—but to point out the impression they leave. Fourth there is the man who occupied himself with aviation only during the war and dropped it like a hot potato at the end. He had only scratched the surface of facts—but his fellow laymen consider him an authority when he airs his misconceptions.

These influences have a cumulative effect--it is surprising the number of men that one finds who were once open-minded but have now reached a conviction that aviation is not going to meet their former expectations.

Demonstration and Education Needed

What is the best means of counteracting these influences? Demonstration and education—flying and advertising—is needed. But what kind of flying? Speed races? Cross-country records? The air mail service? These all help, especially in influencing the expert. But they do not help to convince the general public who in the end foots the bill and who are the ultimate purchasers of all transportation.

Not these activities, but the flight which takes the ordinary citizen into the air for his first "hop"—he first having been

convinced that he should part with two, three or five dollars for the privilege—that is the basic builder of confidence. When he lands safely and comfortably, then you have an unequalled good-will asset and also, if profitably managed, a profit.

The advance made by commercial aviation in 1921 has been largely in a readjustment of prices. In the new prices the industry has a new working asset. But despite this change the increase in operation has been slight.

Passenger Carrying the Real Opportunity

The fleet of tramp and other planes carrying passengers offers the real opportunity of 1922 to the industry. Previously they have constituted a neglected field of effort—undercapitalized, poorly managed and without effective sales promotion. They have even hurt the industry at times. But in the hands of competent management, backed by all elements of the industry they offer a promising field for immediate development.

Cooperation should be given to the competent operators and new operating organizations put into the field. All should be backed with a well-planned advertising campaign which would have the joint object of getting prospects to the airdromes and into the planes and also building knowledge of and confidence in the industry.

The result of such activity will be an increase in the rate with which converted war equipment (now one of the ropes around the industry's neck) is absorbed, and an increased opportunity to put new designs into use. Lastly, the aircraft industry will have started to take control of its market, enabling the making of plans to develop it instead of letting it grow wild.

There is an absorption point to this passenger carrying market, but neither the 1000 planes now operating, nor 5000 nor 10,000 planes do not approach the absorption point in this country of 100,000,000 people. And long before this point has been reached the public mind will have been prepared for the acceptance and use of air transportation routes.

Competent Management

It is hoped that the mere showing of what this market offers will focus attention on its development during the coming year. Of course the exact method of carrying on operations cannot be laid down here as it will vary greatly. But the main thing is to assist ambitious operators and would-be operators to attain competent management and adequate publicity. For competent management it is necessary that all flying must be up to a high standard of safety and efficiency. While legal means of regulation is lacking the Aircraft Underwriters Association is a convenient medium for accomplishing this end. It should be urged and if possible, required, that every plane be operated under the code of this organization. The requirement might even be written into the contract of sale of aircraft for passenger carrying purposes. A standard of management and safety which can be fearlessly advertised will thus be attained.

The location of airdromes for passenger carrying should only be made after a study of the population within reach—a study of both the number and condition of the people and also of the mediums of advertising which reach them. A central bureau could be maintained at small cost to supply this data to operators but to be successful this bureau must be made known to all operators. The manufacturers could well afford to supply this sales promotion service.

The nature of the advertising necessary to stimulate this passenger carrying is limited by the small funds available. The national mediums and the large city newspapers are to be avoided because of the cost of space. Certain Sunday editions might be advisable for stimulating fields near the very large cities. Enough space must be used in each case to make an attractive and educational appeal if the dual purpose of passenger-business and education is to be achieved.

Accessible Airdromes

The population should be within easy reach by automobile and street car travel of the airdromes. A moderate number distributed in several small towns is better than a larger number in the very large cities. Frequently a group of towns can be reached through weekly newspapers or through a daily where the city has only one or two dailies. These low-priced media offer the best and most economical field of activity for the immediate future.

The manufacturers and other elements of the industry could render a service here similar to the "dealer helps" rendered by manufacturers in other industries to the retailers. This service includes the entire preparation of the advertising—and leaves the operator with one expense only—the payment for space used. It also insures that all the advertising will be of the kind and standard that will best serve both the operator and the industry.

The intensive development of the passenger carrying service during 1922 offers, first, an immediate market that will respond to the means at hand; second, a means of absorbing converted war material; and third, a self-supporting method of creating confidence in the industry and the beginning of market planning which is a good method of stabilizing and strengthening an industry.

New Zeppelin for U. S. Navy

The Council of Ambassadors has granted permission to the United States to contract for the construction at Friedrichshafen, Germany, of an airship of the L71 type. This decision marks the end of diplomatic negotiations which have proceeded between the Allied powers and the United States since last July.

The application for the construction of a Zeppelin grew out of the destruction in Germany of five of the big airships, one of which had been allotted to the United States during the peace conference. The United States based its application on the ground that it was entitled to another airship under Germany's reparations agreement. The Council of Ambassadors referred the matter to the principal Allied powers and several notes are said to have been exchanged.

The American request was complicated by a protocol which Germany signed in Paris last June, and which limited the size of airships she might build to 1,000,000 cu. ft. (30,000 cu.m.) capacity. The airship which Germany will build for the United States is to be of 2,470,000 cu.ft. capacity, and there had developed among the Allied governments a decided opposition to establishing a precedent by permitting Germany to go behind the terms of any treaty or engagement.

The opposition of the European governments was overcome by repeated representations by Ambassador Herrick that this country would not use the new airship for military purposes and that America was entitled to compensation in kind for the Zeppelin awarded this government and later destroyed by Germany.

To Be Built in Germany

Under the decision of the Council of Ambassadors, the text of which was received from Ambassador Herrick at the State Department, Germany will construct a Zeppelin of the L71 type at the Friedrichshafen hangar, the only one in Germany large enough to permit the building of an airship of that size, and then will tear down the hangar and disperse the mechanics brought together to build the airship.

The completed airship will be delivered to the United States in Germany without the expenditure of a single penny by this government, it is said, and then will be flown across the Atlantic by a crew of U. S. Naval aeronauts. Construction of the airship will be under the direction of a staff of American navy experts, the personnel of which has not yet been announced.

From nine months to a year is the time estimated by American experts as required for the construction of a rigid ship of the L-71 type.

Personnel for the construction, however, will have to be recruited and organized before actual work can be undertaken, it is said. Since the completion of the two commercial Zeppelins, the Bodensee and the Nordstern, in the record time of five months, rigid airship construction has ceased in Germany, and the mechanics and specialists have entered other industries from which they will have to be won back.

The Trend of Aviation Development *

"Aviation Must be Made to Pay its Way" -- The Influences Retarding its Development

By J. G. Vincent

Vice President of Engineering, Packard Motor Car Co.

Before entering into a discussion of the various elements of the airplane, I would like to review the present art of flying, pointing out the limitations that exist and attempting to eradicate misconceptions as to limitations that do not exist. Wherever the subject of flying is under discussion we hear queries as to why aviation does not progress, why the Government does not do this or that to encourage aviation. I believe firmly that aviation is developing as fast as the state of the art and existing conditions will permit. While I must say that at times the outlook is by no means encouraging, yet on second consideration it is apparent that aviation is following the same inflexible rule that has governed the development of all our transportation facilities. Aviation *must* be made to pay its way; it cannot be coddled on Government subsidies; it cannot be nursed along in half hearted competition with the older forms of transportation; it must prosper on its own merit or not at all. The time is bound to come when we will consider, not whether we can afford to use the plane, but whether we can afford *not* to use it. The steamboat, the railroad, the automobile and the motor truck have all had to fight and fight hard for recognition, and the airplane will have to continue to fight its battle until a truly successful state of development shall have been reached.

The influences that are retarding the development of aviation can be grouped as follows, in the order of their importance: (*a*) lack of landing fields and other facilities for storage and repair; (*b*) the more or less prevalent impression of the dangers connected with flying; (*c*) the lack of comfort for passengers; (*d*) the unsuitability of the average plane for commercial purposes; and (*e*) the difficulty of interesting capital in organizing aviation transportation due to (*a*), (*b*), (*c*) and (*d*). I propose to take up each of these factors in turn and to attempt to point out how, in my estimation, the conditions cited can best be remedied.

Landing Fields

The absence of suitable landing fields in promixity to our larger cities represents the one obstacle that the aviation industry cannot hope to remedy unaided. Federal or municipal aid in this direction is essential and is warranted just as much as is the expenditure for good roads, which will total approximately the fabulous sum of $600,000,000 in 1921. None of this amount is contributed specifically by the automobile industry; the country at large pays and receives the benefit from it. Similarly, it is not to be expected that the struggling aircraft industry can take any part in building up a system of landing fields throughout the country. This phase of the situation was covered thoroughly in the report of the National Advisory Committee for Aeronautics, which was endorsed by the President and submitted to Congress last April.

Before leaving the subject of landing fields, I would like to record a suggestion that I believe will be very much appreciated a few years hence. That is, landing fields should in all cases be equipped with permanent hard-surfaced runways of ample width and length and preferably arranged in the form of a cross so as to permit of landing in at least four directions. Commercial aviation will never be entirely successful until flying can be carried on more or less without regard to weather conditions; at this time soft landing fields are responsible not only for the postponement of many flights, especially in the spring and winter months, but also for frequent damage to airplanes caused by "nosing over" in soft fields. The use of hard-surfaced runways such as are found at McCook Field, Dayton, Ohio, appears therefore to be vital to the success of all-the-year-'round safe flying. Furthermore, these runways offer excellent landmarks when viewed from the air, and it is easier to bar spectators from these well defined areas than from the field at large, thus eliminating another source of danger.

Danger in Flying

I have placed second in the list of influences retarding the growth of commercial aviation the more or less prevalent impression of the dangers connected with flying. These dangers can be classified as real and imaginary. We will consider each in turn, knowing that the real dangers must be overcome by new developments and improvements, while the imaginary dangers must be dispelled from the public mind by suitable propaganda that we can all assist in spreading. First and foremost of the real dangers is undoubtedly that of "stalling." Directly or indirectly, "stalling" is probably responsible for the greatest percentage of fatal crashes. Forward speed is, of course, essential to the sustentation of an airplane and for any given machine at any particular altitude there is a minimum critical speed below which the plane is unable to support itself and will fall out of control for such a distance as is necessary to bring it up to its minimum flying speed. This stalling speed is given in terms of *forward* speed in the line of normal flight. Without going too deeply into technicalities it may be stated that in cases where the airplane is not advancing in a direction parallel with the airstream, the stalling speed will be considerably raised since the airfoil section is designed to give the maximum lift when the airstream is substantially normal to the wing.

Sufficient "flying" speed is therefore essential at all times to the safe control of an airplane; and this speed can be attained either from the motive power of the engine or from the force of gravity in the case of a glide. In the case of all machines in use at the present time it has been found necessary, to permit of proper maneuvering when making a landing or taking-off, to provide an excess of control surface, by which I mean that the lateral, directional and longitudinal controls represented by the ailerons, rudder and elevators are of such ample surface that they are effective at speeds below those at which the plane is capable of supporting itself. The consequence is that it is at all times possible for the pilot to manipulate the controls so as to decrease the machine's forward speed down to a point where it ceases to be subject to his control due to lack of sufficient lift developed by the wings. The pilot can then recover control of the plane only by speeding up the propeller if the engine power is available or by gliding a sufficient distance to obtain the necessary acceleration. It is quite evident that if this "stalling" condition is met within a few hundred feet of the ground with a dead engine, the consequences will be serious, since the height is insufficient to permit of accelerating the plane in a glide to the required minimum speed. This possibility of a pilot being able to bring about a stalling condition, which is manifested also in such maneuvers as side-slipping and tail-spinning, represents a phase of aviation that must be eliminated, I believe, before we can say truthfully that air transportation is as safe as the other modes of travel. Some may argue that the expert pilot will never stall a plane even in an emergency, but unfortunately experience has shown that in the great majority of cases when the engine fails shortly after taking-off, which is one of the worst contingencies encountered in flying, even the most level-headed pilot will instinctively try to bring the machine back to the starting-point, instead of "nosing her down" instantly, regardless of the nature of the

* Paper read before the Society of Automotive Engineers.

landing space directly ahead. Needless to say, if the plane has but limited altitude, this latter maneuver is the only means of maintaining flying-speed and avoiding a stall. Loss of flying-speed is of course not the only cause of a stall or its equivalent; atmospheric conditions, especially just previous to or during a storm, are sometimes responsible, due to eddy currents or sudden variations in the density of the air, which in effect necessitate an instantaneous increase of the minimum flying-speed which will enable the plane to support itself.

The Question of Engine Failure

The popular conceptions of the dangers of flying center around chiefly the possibility of the engine stopping in the air. As I have just pointed out, engine failure can be regarded as extremely serious only during the few initial seconds after taking-off. A forced landing with a dead engine from any reasonable altitude over ordinary flat country rarely results in serious consequences. At an altitude of 5000 ft., for example, and with a gliding angle of 1 in 10, the pilot has a choice of territory comprising an area of about 280 sq. miles or a circle of 19-miles diameter in which to find his landing spot, and he has ample time to study wind direction, ground obstacles and the like, before making his choice. Of course, in cross-country flying it is necessary at times to fly over territory on which it would be very hazardous to attempt a forced landing; such as mountain ranges, large bodies of water and rolling country; in such cases the pilot should be guided by common sense and if necessary make a reasonable detour to limit the duration of flight over such territory, at the same time maintaining good altitude so as to have the advantage of a long glide in case of engine failure.

I am not at all ready to admit that engine failure in the air can be regarded as an unpreventable occurrence. As a matter of fact, the majority of engine failures are due to easily preventable causes and can generally be traced to failures in the gasoline, oil or water systems, which in turn are due to lack of coordination between engine and plane design. Unfortunately ,these troubles cannot be eliminated entirely in practice until considerable flying experience has been obtained with the particular plane under consideration. In other words, with the expansion of commercial aviation, I would look for a great improvement in respect to the so-called "plumbing" troubles that are responsible, I may safely say, for 90 per cent of engine failures in the air. The automobile went through the same transition in this respect, roadside stops being due almost invariably to similar minor faults.

Failures of the plane structure in the air are now practically unknown. Assuming that a given design has been carefully calculated with ample factors of safety, that suitable static tests of wing-truss, fuselage and controls have been made and that reasonable care is exercised in maintenance and inspection, there exists only a most remote possibility of danger due to the collapse in the air of any part of the plane structure.

We have now considered the elements of danger connected with commercial aviation and are in a position to judge to what extent the popular conception is justified. We must first admit that the results of stalling at low altitude are serious. If this could be obviated, a great step forward in the development of safe air-transportation would be made. Once good altitude has been reached, the element of danger becomes negligible and with a properly designed plane and a well tested and reliable engine properly installed, air transportation can be said to be, if anything, safer than any other mode of transportation. The possibility of engine failure will utimately become negligible, but this can be brought about only by a large amount of flying. Planes, even today, are perfectly satisfactory from the standpoint of structural safety and improved constructions are being rapidly evolved.

Single and Multi-Engine Planes

It may be well to review at this point the relative advantages and disadvantages of single and multi-engine planes. A few years ago, before reliable engines were available in quantities, it was thought that the best way to guard against engine failure was to provide additional engines or rather divide up the powerplant into smaller units. Two-engine, three-engine and four-engine, and planes with even more engines have been built and successfully flown. A serious drawback to such arrangement is the necessity for providing a surplus of power in the complete powerplant, resulting in uneconomical operation; in the case of a two-engine plane, for example, it is desirable that each engine be capable of maintaining the plane in the air by itself. While the average plane in taking-off from a small field requires more than double the power necessary to sustain it in the air at its minimum flying-speed, nevertheless two-engine planes as constructed heretofore have not been shown to have a factor of safety against engine failure sufficiently high to warrant the added complications. Of course, in many instances the powerplant demands have been in excess of the power of any proved engine and for that reason in large planes it has been necessary to install multiple units of smaller engines. I am not attempting to cover the whole question of single-engine versus multi-engine planes at this time but will state my belief that for intercity transportation over country providing a reasonable number of emergency landing fields, the single engine plane is undoubtedly the most desirable. The engine should, however, have 30 or 40 per cent more power than is required for normal cruising speed. For long flights over water, forests, mountains or sparsely inhabited regions, a two-engine plane undoubtedly offers additional security, provided either engine alone is capable of propelling the plane at a sustaining speed.

Summarizing, whereas air transportation offers some risks, these are by no means as numerous as is popularly supposed and in practically all cases they are preventable. Engine failure can never be said to be directly responsible for a crash unless it occurs at very low altitude. Undoubtedly the most serious unsolved problem is how to prevent a pilot from stalling a plane under stress of sudden emergency.

Passenger Comfort

The third factor militating against the progress of commercial aviation is the lack of comfort afforded passengers. This is a real handicap. Although it is not at all difficult to persuade the average person to take his first flight, this is generally accomplished in a spirit of adventure or curiosity. The usual comments made by the passengers upon returning to ground are that the sensation was nothing like what had been pictured; in fact, that the experience was rather mild. The noise of the engine and the propellers are severely criticized and if the trip was lengthy and at considerable altitude the cramped quarters and cold probably receive unfavorable comment. Of course, there have been introduced abroad, and to a limited extent here, planes offering enclosed passenger accommodation that approaches the luxurious. Much more must be done in this respect ,especially in this country where railroad equipment has been developed to a point where one can travel with practically all the luxuries of a hotel at his command. There is nothing inherently impossible in providing similar service through the air, but this would require ample capital and special design throughout.

Probably the most difficult problem lies in suppressing the noise of the engine and the propeller but this also must be done before air transportation can rival ground transportation on the score of comfort.

Commercial Considerations

The fourth unfavorable influence so far as the progress of aviation is concerned was given as the unsuitability of the average plane for commercial purposes. This is largely responsible for the difficulty in interesting capital in commercial flying ventures. It is fairly well known how wartime machines have been built over in an endeavor to construct a peacetime passenger-carrying plane and also the indifferent results accruing from this procedure have been appreciated. Excellent planes have been built since the war for passenger carrying and many of these are giving splendid service abroad. But the costs of operation and maintenance, as well as the rate of depreciation, of these are so high that it is very doubtful whether any of the ventures based on their operation

could pay their own way without the generous subsidies provided by enterprising foreign Governments.

Looking at this matter from a cold businesslike standpoint we can see that the saving in time afforded by air transportation offers an inducement to the business or professional man that can be measured in just so many dollars. For example, there is a limited demand for extra fast trains, say, from New York City to Chicago, and the saving in time is considered to more than offset the extra fare paid for this service. It is safe to assume that for still faster service a higher fare in proportion to the extra time saved would readily be paid. Unfortunately, there is a limit to the possible saving in time, due to the fact that long overland trips are invariably made overnight, the average business man considering a night in a Pullman not very much more of a hardship than a night in a strange hotel. The result is that to prove its worth air transportation must save *daylight* hours for the average traveler. Furthermore, even on comparatively short overland trips, of say 200 miles, the average man will prefer going aboard a train at 10 p. m., turning into his Pullman berth and getting up in the morning at his destination, the train having actually been moving perhaps only 5 hr. of the time. On such a run the real inducement to be offered by the airplane is the making of the round trip in 4 hr., leaving a good part of the day available at either end of the journey for the transaction of business.

Finally, we come to the subject of interesting capital in commercial aviation. This is an extremely knotty problem for the reason that it takes considerable capital to demonstrate the possibilities of a fair return on an investment of this character. Furthermore. I believe that not even aviation's staunchest supporters will claim that commercial aviation can be made to pay from the start. There is bound to be a period of development and experimentation that will more than absorb all possible profits. Again, what protection is there for the pioneer? If it were possible for the Government to grant exclusive franchises over certain air routes for extensive periods, there might be a chance of inducing capitalists to invest; but I hesitate even to suggest the possibility of such franchises. Without such protection the pioneers would be forced to develop at considerable expense the most suitable flying equipment, schedules, routes and many details of organization that competitors could duplicate a few years later, driving the pioneers, burdened with the heavy expenditures incurred during the development stage, out of business.

I have attempted to present the status of commercial aviation today in the United States and propose to consider now the general trend of plane and engine design.

Trend of Design

For the purposes of this discussion we will consider in turn the three principal elements of the plane, the wing truss, fuselage and powerplant. In reviewing design tendencies in these fields I propose to cover the ground rather broadly as it is the object of this paper to bring out some constructive ideas that may assist in some slight measure in the advance of commercial aviation in this country, rather than to get into a discussion of the relative merits of different designs. At the outset let us decide what type of airplane it behooves us to consider in this connection. Of the two types, water and land planes, there is little question that the future of commercial aviation must rest chiefly with the latter. There are some splendid but limited opportunities for the use of hydro-airplanes and flying boats along our coast and between our Lake cities, and these fields are being gradually developed. The chief advantage of the water machine rests with its ability to "land" on any suitable body of water, weather conditions being reasonable. The need of expensive landing fields is obviated and the initial investment thereby reduced. On the other hand, the routes are necessarily restricted and the machines themselves are far less efficient than land planes due to the high parasitic resistance of the hull and pontoons. It is indeed a question whether land machines fitted with emergency flotation gear are not preferable over water routes of not too great length; it may be remembered that all air transport across the English Channel is by land machines. Assuming, therefore, that our discussion is to be confined to land machines, what particular type should we consider as best meeting the immediate needs of commercial aviation? There are many conflicting aspects of this phase of the problem. From an operating standpoint we are justified in expecting that the lowest operating cost would be associated with rather large planes, having ample capacity for passengers and freight. On the other hand, the initial investment and risk of damage would be proportionately greater with the larger units. All things considered, I believe we can safely say that the smallest plane that can be economically operated and be made to pay in commercial service would have a capacity of about 10 passengers or approximately 2000 lb. of freight. While this may sound like more or less of an arbitrary conclusion, it is based largely on present day knowledge of structural limitations.

Considering now the wing truss for such a machine there are two general types of construction to choose from. The first is the older and conventional, externally braced, trussed

Reporting by airplane is becoming increasingly popular with progressive newspapers, for it enables them to get many a scoop

type, generally of biplane form; the second is the more recent, internally braced, thick wing section, generally associated with monoplane design. This latter type lends itself particularly well to all metal construction. From the commercial standpoint there are many points in favor of the internally braced wing, chief of which are the decrease in maintenance and inspection costs, improved economy in operation due to improved aerodynamic performance and the ability to make quick repairs by replacing the entire unit. The possibility of storing fuel and freight in the wing is quite alluring, and the improved vision for the passengers must not be overlooked. All things considered, it is evident that the internally braced wing presents overwhelming advantages for commercial planes. Just what material should be employed in the wing structure is a question of less import. An all metal structure offers theoretical advantages from an upkeep standpoint. On the other hand, it is necessarily more rigid than a built-up wood construction reinforced with suitable tension wires, and the resistance to fatiguing stresses induced in the metal wing by the fine vibrations transmitted from engine and propeller is questionable. If ultimately crystallization is to set in and sudden fracture take place, the consequences might be exceedingly grave. Summing up, it is evident that the internally braced wing is exceptionally well suited for commercial planes, but that all metal wings of this type will continue to be looked on with suspicion until a large amount of experience shall have shown that they have practically an unlimited life and cannot be said to depreciate with use.

All things considered, I think it is a fair statement to make that the question of a specific wing-truss is not a material factor in the advance of commercial aviation. In other words all present standard forms of construction can be considered satisfactory for commercial purposes, although, as remarked above, some of the newer constructions will undoubtedly effect

savings in upkeep and hence bring the air transportation era one step closer.

Fuselage Construction

Taking up the question of fuselage construction, we recognize that there exists a general tendency in design toward more rugged construction, considerable attention being paid to securing reduced cost of manufacture and upkeep. The built-up veneer trussed type appears to be giving way to the all steel truss type. One form of construction which seems to be excellent is that in which the fuselage is constituted of steel-tubing units welded-up in jigs and reinforced by tension wires. The question of fuselage design is dominated by the need of an accessible powerplant mounting. In the present stage of aircraft engine development it is necessary to overhaul the engine rather frequently, that is, every 200 to 300 hr. at least, and it is therefore important to be able to remove it in a minimum length of time so as not to tie up the plane for an undue period. In fact, the ideal scheme seems to be to have a spare powerplant available at all times for substitution. The steel fuselage lends itself particularly well to the accomplishment of this very desirable feature of accessibility and this can be carried out in a clean cut manner by extending the upper and lower longerons on each side so as to meet at the front of the engine support. In the older forms of veneer-covered-truss fuselages or with the so-called monocoque construction the engine was generally extremely inaccessible, at any rate from both sides.

Regarding the general cabin design for the passenger compartment the requirements in the matter of comfort, good vision and ventilation seem obvious. Later we may expect to see serious consideration given to attempting great structural strength in the cabin structure to protect the passengers as much as possible in case of a crash. This would follow the precedent set in railway Pullman car construction but, of course, the problem in the case of aircraft is rendered far more difficult by minimum weight requirements. Easy access to the cabin from the ground is naturally desirable from the passenger's standpoint and in most enclosed designs this has been carefully studied.

Location of Pilot Cockpit

There is apparently considerable difficulty in arriving at the best location for the pilot. The first requirement is, of course, the best possible vision not only for landing but also, while in the air; the pilot should be able to see in all directions. In the event of the plane nosing over, the pilot should be in such a position as to be protected from the engine, gasoline tanks or other heavy units. It is undoubtedly desirable, although not essential, that the pilot be able to obtain access to the passengers' compartment, and there should be also accommodation for a mechanic or relief pilot. The pilot's cockpit should be in such a place as to simplify both the plane and the engine controls, making them as direct as possible. Of course, in the case of a multi-engine plane in which the engines are carried out on the wings a suitable position for the pilot is readily found in the forward part of the fuselage, but with the single-engine plane some other location must be found. In a very recent design the pilot is placed alongside of the engine; this appears to have some advantages.

I have not considered the tail skid or landing gear separately but these very important elements of the design need much study and development to reduce the present high cost of upkeep. There appears to be a definite need for some shock absorbing means in both the landing gear and the tail skid. By shock absorber I mean a device to actually absorb the shock and not store it momentarily as is done with springs or elastic rubber suspensions.

The location of the gasoline tanks is another problem that has not reached a final solution, in my estimation. There are several factors to be taken into consideration, such as the method of gasoline feed, that is, pressure or gravity, the capacity of the tanks, and effect of the full or empty tank on the respective balance of the airplane, remoteness from any fire producing element and accessibility for filling. The most important consideration of all is undoubtedly that of fire prevention and on this score a location out on the wings is preferable.

Scanning the question of the powerplant for a typical commercial airplane, the first requirements we encounter are reliability and accessibility. Next in order come economy in operation and low initial cost. In the matter of reliability of the engine itself, a high state of development has been reached, although the powerplant as a whole has not advanced in a coresponding degree due to the lack of coordination of engine and plane design and the incomplete working out of important installation details. This handicap is being overcome rapidly as engine designers become more familiar with actual airplane operating conditions and plane designers appreciate more and more the installation and operating requirements of the the powerplant. Basically, then, we find that there exist several well known makes of engine that are highly reliable. The next step is to produce reliable engines that will lend themselves to simple installation and easy maintenance. This phase of the situation is well understood by all airplane engine designers, as is shown by some typical examples of modern powerplants referred to later. It should of course be borne in mind that the engine designer must lead the way, since the plane must be built around the engine to form an harmonius combination. The problem therefore requires the closest possible cooperation between the engine and the plane designer. Both should acquire extensive flying experience to obtain the best possible insight into operation and maintenance problems.

Powerplant Requirements

Carburetion is undoubtedly the foremost of the concrete examples of powerplant requirements, since the location of the carburetor has considerable influence on the design of the engine and affects the design of the plane. The ideal gasoline system seems to be gravity feed, owing to its inherent simplicity and consequent reliability. Assuming a fairly high location for the gasoline tanks, it is easy by placing the carbureter beneath the engine to obtain a very efficient gravity feed with ample head under all normal flying conditions. There are several other advantages in thus locating the carbureter, including the ability to carry the air intake out through the lower cowling, eliminating any possible danger of fire due to engine backfiring. It is, of course, important to carry gasoline overflow pipes or vent connections into the air intake so that in case of flooding the gasoline will drip harmlessly from the air intake. It should be remembered that in the case of the conventional single-engined tractor powerplant installation the engine is most accessible from beneath or from either side, whereas in the case of the automobile engine the sides and top are easiest to work on.

Next after the carbureter comes the lubricating system in importance as regards accessibility requirements. This applies to such important elements as the oil pump itself, pressure regulating valve and oil screen, all of which should be readily accessible in the completed plane. It appears to be good practice to operate the engine with a dry sump; in which case an external oil tank, which serves also as an oil cooler, must be provided in proximity to the engine.

The water pump is usually driven from a vertical shaft at the rear end of the engine and can thus be easily inspected from underneath. The ignition system, which should invariably be supplied in duplicate whether it be in the form of magnetos or battery distributors, is best arranged at the rear end transversely with respect to the crankshaft so that adjustments or inspections can be made from either side. The location of the sparkplugs is more or less determined by the general type of engine construction, but one set at least should be readily accessible from either side; in the case of a V-engine the other set can be located conveniently in the V if there is plenty of space available. In this case a suitable sliding door should be provided in the upper part of the cowling so that these sparkplugs can be reached without removing the cowling as a whole.

The radiator should be considered as part of the powerplant, since its design is tied up with the characteristics of the particular engine employed. There are several alternative locations for the radiator, but the so-called "nose" radiator

directly behind the propeller appears to have overwhelming advantages for commercial purposes. Although this is by no means the most efficient position for a radiator so far as its cooling ability is concerned, it appears that for convenience in connecting to the engine and for general accessibility it offers sufficient advantages to warrant its general adoption for commercial planes. The radiator should have ample area and a liberal expansion tank, together with an efficient shutter equipment. It is important that the shutters fit well when closed; and it is preferable that they be balanced and streamlined so as to offer no difficulty in maintaining any desired adjustment in flight. Apparently it is good practice to mount the engine on wood bearers. These can be extended to carry a suitable stamping that in turn supports the radiator. These same timbers can also be extended through the engine firewall to support the gasoline tank if such a location is suitable.

Engine Installation

There are a great many very important details in connection with the installation of the engine and its controls; these deserve the closest possible attention. Gasoline, water and oil lines must all be worked out with a view to their withstanding vibration, but at the same time the use of rubber hose for either water or oil connections should be limited as far as possible, suitable metallic linings being employed to prevent any possible obstruction by rubber particles disintegrated by the action of the gasoline or oil. Needless to say, in every case where rubber connections are used for gasoline or oil, strainers should be provided in a very accessible location on the engine side of the joint. Engine controls, such as spark, throttle, mixture and radiator shutter, should all be carried out in a mechanical and workmanlike manner. The use of flexible cable for such work is not to be recommended. The construction should take the form of tubular connecting rods combining lightness with rigidity, bell cranks and levers connected with suitable clevises, and the proper number of bearings suitably arranged to carry the various shafts with the least cramping tendency. It is desirable to carry out a mechanical, positive construction such as that outlined above in all the flying controls; that is, in an ideal system no flexible cable would be used for operating ailerons, rudder, elevator or adjustable stabilizer if used. The propeller also can be considered an important part of the powerplant since in its design the characteristics of the engine must be taken into consideration, although the airplane itself exerts a considerable influence on the propeller design.

Self Starters

The question of starting means for airplane engines has been frequently discussed, with various results. The electric starter is apparently the only available successful mechanical starter attached to the engine. Its use, naturally, necessitates the employment of a storage battery. The battery involves some objections from the standpoints of maintenance, weight and injury to metals or wood in its vicinity. All things considered, the use of a mechanical engine starter on a commercial airplane is open to question, since with suitable priming devices, handcrank magneto, etc., the engine can be started very readily by hand. Experience alone will show whether the advantages of the electric starter are sufficient to overcome such disadvantages as I have cited.

I have purposely refrained from discussing air cooled engines or other types of powerplant, since the purpose of this paper is not so much to point out future possibilities as to present the status of commercial aviation today, placing particular stress on retarding influences. I believe, in general, that there are several types of modern high grade powerplant from which to choose and that the lack of a suitable powerplant cannot be said to be obstructing the advance of commercial aviation, although I look forward to constant improvement of the engines in the direction of greater reliability and economy and decreased cost of construction with not very much reduction in weight.

Essentials of Air Transportation

Having considered the question of commercial aviation from different angles, we are in a position to specify some of the more important steps necessary in the futher development of air transportation. As I have stated, this paper is necessarily too limited in scope to include a discussion of a multitude of detail refinements, each of which will contribute its quota to commercial aeronautics. I might cite navigating instruments, which are the basis of a large field for development, and wireless direction finding, wireless telephone and night flying equipment. There is great need for propellers of moderate cost that will withstand the attacks of rain or sleet; variable pitch and reversible propellers are gradually being evolved from the experimental stage. Considerable work is being done on wings having variable camber or variable surface. These few examples of development activities in the various branches of airplane design indicate the ramifications of the art and the hopelessness of attempting to present a complete picture of the situation. I have tried to pick the high lights and draw some general conclusions from them.

Conclusions

Summing up, I have enumerated the following four points which may be said to represent the essential and fundamental requirements for the further progress of commercial aviation:

(1) A system of landing fields must be determined upon and put into service throughout the country as rapidly as possible. Although at the outset air traffic will be extremely limited, unless these landing fields are available in advance, I can see no hope for the rapid extension of commercial air transportation. I am glad to note that the daily press is giving its support to the movement to construct municipal landing fields throughout the country.

(2) The aid of Government experimental stations should be enlisted in the task of eliminating so far as possible such danger factors as are inherent in the present airplane designs. I have in mind chiefly the matter of stalling which is referred to at considerable length above. A partial solution of this problem may lie in having an intermediate stop for each set of flying controls, that would allow sufficient range for normal flying, although perhaps not sufficient just previous to landing or when taxiing. A Federal system of inspection, coupled with suitable short period licenses and stringent regulations governing important elements of aircraft design, would undoubtedly assist in preventing a certain percentage of avoidable accidents.

Mail Contracts and Airway Franchises

(3) Government patronage of air transportation companies in the form of mail contracts, which might be made somewhat more liberal than the present ones by charging a very nominal extra postage. I am fully aware that at the outset of the Air Mail Service this procedure was not successful in attracting patronage, but I believe this was due to an excessive surcharge. A preferable course might be to limit the weight to one half that allowed by rail route for the same postage. I have touched upon the possibility of establishing Government franchises over specific air routes. While I recognize the crudity of the suggestion, some means might be devised of restricting the number of Federal licenses to be issued to air transportation companies to operate between any two points for a definite period. Such licenses could have qualifying clauses stipulating a minimum number of trips or in some other way insure adequate service.

(4) Both plane and engine development along utilitarian lines should be concentrated on by our Government experimental stations. In the final analysis, even in time of war, reliability and ease of maintenance are important factors. In the past we have been paying almost exclusive attention to the performance of our military planes, which was, of course, a laudable endeavor. Nevertheless, it appears to be equally important to encourage development work that would be more applicable to peacetime flying, recognizing that the fruit of this would be extremely valuable in the evolution of commercial aeronautics, which in turn would help build up what would be in effect a Reserve Air Force. In other words, neither extremely high speed nor rapid climbing to excessive altitudes represents characteristics of particular value to commercial air transportation, whereas increased economy in operation, slower depreciation and decreased upkeep expense are all vital factors in this connection.

"Who's Who in American Aeronautics"

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The biographical sketches of men who are prominent in American Aeronautics are printed periodically in AVIATION. The first series will be shortly published in a more durable form, and revised issues will be published semi-annually to take care of the frequent changes in station of Army and Navy officers, and such other changes as may occur. As errors and omissions are liable to occur in a compilation of this character, interested parties are requested to notify "Who's Who" Editor of the necessary corrections so the record may be kept up to date.

Thomas Fenton Dunn

DUNN, THOMAS FENTON, Professor; born, Cadillac, Mich., Oct. 9, 1886; son of Michael B. Dunn and Elizabeth May Dunn; married, Oct. 22, 1918.

Educated: Public schools; St. Francis Academy, Toledo; University of California.

Professional: Railroad Messenger to Traffic Manager; Corporation Purchasing Agent; Constructing Engineer on bridges and highways; topographer, commercial aviation, designing, construction and operation of airplanes; commercial aviation projects.

Aeronautical Activities: 1916-1917, Experimental work on Aero Photo Maps; 1917, enlisted in Aviation Section, Signal Corps; flying instructor; combat gunners pilot; discharged Dec. 1918; entered commercial aviation field, Jan. 1919; 1920, established first commercial air line between Detroit and Cleveland, Aug. 1920; carried mail and merchandise; established aeronautical course, University of Detroit.

Flying Rating: Aero Club of America License No. 1633.

Member: Aero Club of America; University Club (Detroit); Aviation Country Club, Detroit.

Present Occupation: Dean, Department of Aeronautics, University of Detroit.

Address: 630 Jefferson Ave., Detroit, Mich.; home, 1924 Calumet Ave., Toledo, Ohio.

Fauna Wynne Farris

FARRIS, FAUNA WYNNE, Commercial Aviation; born, Lawrence, Kans., Aug. 25, 1889; son of David J. Farris and Annie Farris; married, Edna Ingels, May 14, 1920.

Educated: Palo Alto High School, Palo Alto Calif.; A.B. 1917, Stanford University.

Professional: Owner and Manager, Stockton Aviation Center, Sept. 1919 to date.

Aeronautical Activities: Overseas service, July 1918 to Feb. 1919; Pilot, 24th Aero Squadron; civilian aviation, Sept. 1919 to date.

Flying Rating: French Military Brevet; Reserve Military Aviator, July 20, 1918.

War Service: French Army S.S.U. No. 10, June 1917 to Dec. 1917; A.E.F., Dec. 1917 to July 1919.

Present Occupation: Owner and Operator of Stockton Aviation Center.

Address: 2049 South California St., Stockton, Calif.

James M. Porter, Jr.

PORTER, JAMES M., Jr., Automobile Business; born, Easton, Pa., March 7, 1896; son of James Madison Porter and Mary Virginia (Drake) Porter.

Educated: Private schools; Lafayette College.

Professional: Automobile business.

Aeronautical Activities: M.I.T. Ground School; training and instructing, Pensacola, Fla.; land flying at Miami, Fla.; Campagne, Field B., Northern Bombing Group, France.

Flying Rating: Ensign, June 1918; Naval Aviator No. 655.

War Service: Northern Bombing Group, France.

Present Occupation: Automobile business.

Address: 243-49 N. 3rd. St.; home, 53 N. 3rd St., Easton, Pa.

Charles Bierer Wrightsman

WRIGHTSMAN, CHARLES BIERER, Oil Business; born, Pawnee, Okla., June 13, 1895; son of C. J. Wrightsman and Edna Wrightsman.

Educated: Phillips Exeter Academy; Columbia University.

Professional: Oil producer.

Aeronautical Activities: Winner, efficiency trophy for sport model planes at American Legion Flying Meet, Kansas City, Nov. 2, 1921 in S.V.A. also owner of S.V.A. plane winning Larsen Efficiency Trophy at Omaha, Nov. 5, 1921.

Flying Rating: Naval Aviator.

Member: Aero Club of America.

Present Occupation: Oil business.

Address: 120 Broadway; home, Plaza Hotel, New York City.

R. R. Fetterhoff

FETTERHOFF, R. R., Aerial Photography; born, North Baltimore, Ohio, July 3, 1892; son of Emmett C. Fetterhoff and Emma B. Fetterhoff.

Educated: Tri-State College.

Professional: Teacher from 1910 to 1913; District and General Manager, Life Insurance Agency, 1913-1917; U. S. Army, 1917 to 1919.

Aeronautical Activities: Columbus Ground School, 1917; Cadet at Wilbur Wright Field, 1917-1918; flying training at Gerstner, Hazelhurst and Ellington Fields; transferred to Luke Field, Honolulu, H. T., May 1918 and assigned as Personnel Adjutant; after discharged from Army, organized the Aerograph Co. which conducts an aerial photographic business and supplies demand for mosaic maps and obliques of real estate allotments, factories, private estates, etc.

Flying Rating: Reserve Military Aviator, Jan. 1918.

War Service: Aug. 1917 to Sept. 1919.

Member: Cleveland Aviation Club.

Present Occupation: President, The Aerograph Co.

Address: 304 Sloan Bldg., Cleveland, Ohio.

Edmund Turney Allen

ALLEN, EDMUND TURNEY, Student; born, Chicago, Ill., Jan. 4, 1896; son of Edmund T. Allen and Abby D. Allen.

Educated: Chicago High School; University of Illinois; Mass. Inst. of Tech.

Aeronautical Activities: Ground School at U. of Ill.; primary training at Scott Field; advanced training at Gerstner Field; acrobatic instructor at Love Field; Martlesham Heath, England on special mission for Technical Section; Major Schroeder's Test Squadron, Dayton, Jan. 1919; Langley Field on Special duty to Aug. 1919; National Advisory Comm. Test Pilot, 1919 and 1920.

Flying Rating: Reserve Military Aviator.

Member: Aero Club of America.

Present Occupation: Student of Aeronautical Engineering at M.I.T.

Address: 881 Massachusetts Ave., Cambridge, Mass.

Hugh Hatfield Barker

BARKER, HUGH HATFIELD, Commercial Aviation; born, Norton, Kans., April 19, 1897; son of I. C. Barker and Eva Barker; married, Marion E. Brown, Jan. 10, 1920.

Educated: Public schools.

Aeronautical Activities: Army, July 1918 to Jan. 1919; instructor from Oct. 1918 to Jan. 1919; Donaldson Bros. Flying Circus, 1919; flying in Central and Southern states, 1919-1920; formed Barker Aircraft Corp., March 1920; continued until March 1921 when the Corp. became the H. H. Barker Aircraft Co.

Flying Rating: Reserve Military Aviator, Oct. 1918.

War Service: Idaho National Guard, April to Nov. 1917; Signal Corps, Nov. 1917 to March 1918; School Military Aeronautics, 1918; discharged Jan. 1919.

Present Occupation: Commercial Aviation.

Address: Gooding, Kans.

Mart H. Adams

ADAMS, MART H., Commercial Aviation; born, Hartville, Mo., Dec. 2, 1888; son of William P. Adams and Sadie Adams; married, Edna Russell Vance, June 20, 1915.

Educated: Public schools of Logan County, Okla.

Professional: Telegraph operator, 1905-1906; 1906-1909, Railway business, Salesman, Sales Manager, 1909 to 1916; Coal business, oil business, 1916-1917; manufacturing, 1918 to 1920.

Aeronautical Activities: First airplane distributor in Oklahoma; first owner of public airplane hangar and field in Oklahoma.

Present Occupation: Airplane ditsributor, Southwest.

Address: 117 West 2nd St.; home, 1224 N. Robinson St., Oklahoma City, Okla.

John Willis Hines

HINES, JOHN WILLIS, Engineer; born, Riverton, Conn., Dec. 12, 1891; son of John T. Hines and Julia C. Hines.

Educated: Winsted Grammar School; Gilbert School, Winsted, Conn.; Farmington High School; B.S. 1914, Mass. Inst. of Tech.

Professional: American Tel. & Tel. Co. Aug. 1914 to date.

Aeronautical Activities: March 1916 to April 1917, Aeronautical Section, Naval Militia of New Jersey; U. S. Naval Air Station, Bay Shore, L. I.; Ground School, Mass. Inst. of Tech.; Naval Air Station, Pensacola, Fla.; bombing and machine gun practice, France, 1918; U. S. Naval Air Station, Killingholm, England; North Sea Patrol for submarines and convoy for merchant ships; Royal Seaplane Station, Scotland for cooperation with British Grand Fleet; Jan. 1918 to Jan. 1919, U. S. Naval Air Station, Chatham, Mass.

Flying Rating: Naval Aviators Certificate No. 338.

War Service: As above.

War Honors: Citation, Nov. 11, 1920.

Member: Technology Club (N. Y.).

Present Occupation: Engineering Department, American Tel. & Tel. Co.

Address: 195 Broadway; home, 17 Gramercy Park, New York City.

Robert McKnight

McKNIGHT, ROBERT, Advertising; born, St. Louis, Mo., Oct. 31, 1891; son of William C. McKnight and Irene B. McKnight; married, Alberta Boyd, June 11, 1919.

Educated: Public schools of Chicago; Ph.B. 1915, University of Chicago.

Professional: Newspaper reporter and editor, 1915-1917; advertising copywriter and plan man, 1919 to date.

Aeronautical Activities: Entered Ground School of University of Illinois, Sept. 1918; A.E.F. with 14th Foreign Detachment Flying Cadets; flying training at Issoudun, France.

Flying Rating: French Brevet, Aug. 1918; Reserve Military Aviator, Aug. 1918.

War Service: Air Service Signal Corps, Sept. 1918 to Feb. 1919.

Present Occupation: Advertising copywriter.

Address: 1204 Thorndale Ave.; home, 1617 Columbia Ave., Chicago, Ill.

Noel E. Bullock

BULLOCK, NOEL E., Commercial Aviation; born, Franklin, Nebr., March 31, 1899; son of Guy B. Bullock and Mary E. Bullock.

Educated: Public schools of Madrid, Nebr. and Smith Center, Kans.; Franklin Academy, Franklin, Nebr.

Professional: Automobile business, 1917 to 1921. (Amateur racing).

Aeronautical Activities: Mechanic and Pilot, Victory Flyers, Nov. 1919 to July 1920; Chief Engineer and Test Pilot, North Platte Aircraft Co., July 1920 to Aug. 1921; owner, Bullock School of Flying, Aug. 1921 to date.

Flying Rating: Commercial Pilot.

Member: Nebraska State Air Association.

Present Occupation: Owner and instructor, Bullock School of Flying.

Address: North Platte, Nebr.

Arthur H. Becker

BECKER, ARTHUR H., Clothing Manufacturing; born, Kulpsville, Pa., June 26, 1894; son of Joseph F. Becker and Anna W. Becker.

Educated: Public schools; Lansdale High School; Brown Preparatory School; Lafayette College.

Aeronautical Activities: M. I. T. Aug. 1917; Tours, France, Nov. 1917; Brevet, May 1918; Issoudun, France, May 1918; ferry pilot and test pilot, 1st Pursuit Group; arrived in U. S., Feb. 1919.

Flying Rating: Reserve Military Aviator; French Brevet.

War Service: July 1917 to Feb. 1919.

Present Occupation: Clothing Manufacturing.

Address: Kulpsville, Pa.

Functioning of Supercharger in Altitude Flight

Experience of Lieut. John A. MacReady on Record Breaking Altitude Flight Shows Difficulties Met in Exceeding 40,000 Ft.

Below is printed an excerpt from the report of Lieut. John A. MacReady, A.S., on his record-breaking altitude flight at McCook Field, Sept. 20, 1921. This portion of the report deals with the technical aspects of the flight, giving a summary of the data obtained with respect to the supercharger, engine and propeller. Lieutenant MacReady's observations will be found of unusual interest.—EDITOR.

"The flight was made for the purpose of climbing supercharged LePere P-53 to its absolute ceiling with one man. An extremely large propeller was used for the purpose of keeping down the revolutions per minute of the engine at high altitude. This propeller turned up 1100 r.p.m. on the ground. It was assumed that with such a low r.p.m. at low altitude that the r.p.m. would be approximately normal as the plane approached its ceiling. It would be giving its most efficient power at high altitude without endangering the engine and supercharger by overspeeding it.

"On leaving the ground the supercharger registered 3000 ft. below sea level. This supercharger altitude was allowed to rise until sea level conditions were registered on the altimter, and was kept at this point by applying the supercharger throttle until 7000 ft. was reached, and was not touched from that point, with the exception of once or twice when it was necessary to reduce supercharger capacity, until an altitude of 35,000 ft. was reached.

"A peculiar and unusual condition arose during the flight. Instead of putting on supercharger with altitude, it was necessary to gradually take off a little supercharger as altitude was gained. The propeller r.p.m. speeded up with altitude, this probably accounting for the increased supercharging capacity, with the resultant necessity of taking off supercharger to keep it at sea level condition and thus avoid preignition. There did not appear to be an increase of r.p.m. after 35,000 ft. was reached, and from this point on it was necessary to give additional supercharger to keep the supercharged altimeter dial indicating sea level conditions.

"At the ground the r.p.m. of the propeller was 1100, and gradually increased to an r.p.m. of 1680 at 35,000 ft. The r.p.m. remained at this point until an indicated ceiling of 41,200 ft. was reached. Sea level conditions were maintained until 40,800 ft. were obtained.

"With the supercharger at capacity and the engine full on, registering sea level conditions, it was assumed that the climb could be continued into some region of pressure above the point of 100 per cent supercharger efficiency. This assumption was based on the theory that the supercharger efficiency would drop off probably, as in the case of the unsupercharged engine power losses with altitude.

"With the supercharger registering sea level conditions (100 per cent efficiency) at 40,400 ft., this assumption seemed reasonable, but the developements in the next few minutes of climb did not justify it. From 40,400 ft. but slight altitude was gained, the supercharger dial registering a tremendous falling off. Although it was expected that at least 6000 or 7000 ft. more altitude would be realized, but 400 ft. more altitude was gained. Within a climb of this small distance supercharging conditions within the engine went from sea level to approximately 6000 ft. above sea level, at which point the airplane remained suspended as to altitude. This was the absolute ceiling of the airplane—it would go no higher.

"The extreme lightness or the lack of density of the atmosphere at altitude also affects the efficiency of the airplane itself and does not permit the same climbing conditions, even with sea level power on the engine."

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of the
AERO CLUB OF AMERICA

Requests all owners (individuals or companies) of aircraft in the United States to register in order that the Committee may

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Motor, Make and Model .....

Maximum speed of .....m.p.h.

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Underwriters' Laboratories Aircraft Registration No. .....

Pilot's name .....

Address .....

Owner's name .....

Address .....

Library
Air Corps Tactical School
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Foreign Aeronautical News

Brazil

A committee of the Brazilian Senate has reported favorably, according to the United States Naval Attache in Rio Janeiro, upon a bill proposing the establishment of two air lines between Rio de Janeiro and Porto Alegre, which are to be started before September, 1922. One of the routes will be laid out along the coast, carried out by seaplanes, and maintained and directed by the Ministry of Marine; the other will traverse the interior of the country to the west of the coast range of mountains, and will be carried out by airplanes under the direction of the Ministry of War. The routes will pass through the most important political, industrial, and commercial centers wherever possible.

Great Britain

A large airplane, which has been undergoing speed trials at Farnborough for the past few weeks, will probably be put through a full test very shortly. This machine is the biggest in the Royal Air Force. With its twin Siddeley-Deasy engines it can develop nearly 1,000 hp. It has fighting turrets on each side of the fuselage, with provision for machine gunners and bombers. In the trials it will probably carry a crew of ten which, with the weight of the machine and its complement of guns, will bring the gross weight to something like ten tons.

Croydon airdrome (London) has now a fresh point of interest for the visitor. The Air Ministry authorities have erected a large map showing the airways of Europe in black lines. Along these routes, at intervals representing ten miles, are nails on which small models of airplanes, marked with the sign of the respective companies, are hung. When a machine leaves Croydon, or is signalled as having left another airdrome for Croydon, its representative is placed on the map. An attendant moves it along the route from time to time, its progress being worked out by means of a knowledge of the speed of the machine. As many aircraft are now fitted with wireless, the pilot will signal down his position from time to time so that the position of the model on the board may be checked.

Already firms, and friends of passengers, are finding the map of great use, while visitors to the airdrome appear very interested in watching the progress of the machines which they have seen leave.

Upon similar lines to the specialist branches for gunnery, torpedo, navigation and signals, the British Admiralty have decided to make a specialist branch of the Air Observers among naval officers. For the present eight officers will be selected each half year. In time, only junior lieutenants of two years and upward will be selected, as in other specialist branches, but a few commanders and lientenant-commanders are required immediately for training. Courses, each of seven months duration, will begin in May and November in each year, and will include two months' preliminary training at the naval schools in gunnery and signals, and five months at the seaplane training school at Lee-on-Solent.

Netherlands

The aerial service between London and Amsterdam has been temporarily suspended for the winter months. This service, which is run by a Dutch company known by the initials of K.L.M., and using Fokker machines, began operations in April. Since then the company's aircraft have made 352 flights between London and Amsterdam.

In April next year the company intends to reopen the route with one service each way daily, which will be increased to two services a day on May 1. The subsidy of Fl. 200,000 granted to the K.L.M. by the Dutch government for the years 1920 and 1921, which was intended to meet two-thirds of the company's estimated losses, has proved to be insufficient, and an increase of subsidy, amounting to Fl. 260,000 has been applied for. The total estimate for civil aviation included in the Dutch budget of 1922 amounts to Fl. 1,315,000, of which Fl. 370,000 is asked to cover two-thirds of the company's estimated losses in the coming year.

During five months this year the K.L.M. service carried 410 passengers between London and Amsterdam and, beside mails, nearly 18,000 tons of goods, nearly all British exports.

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